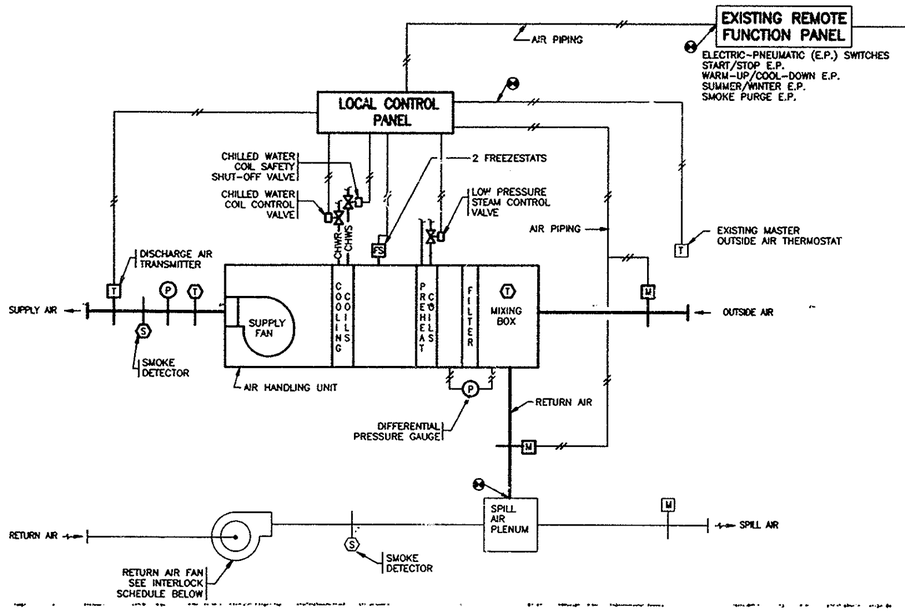
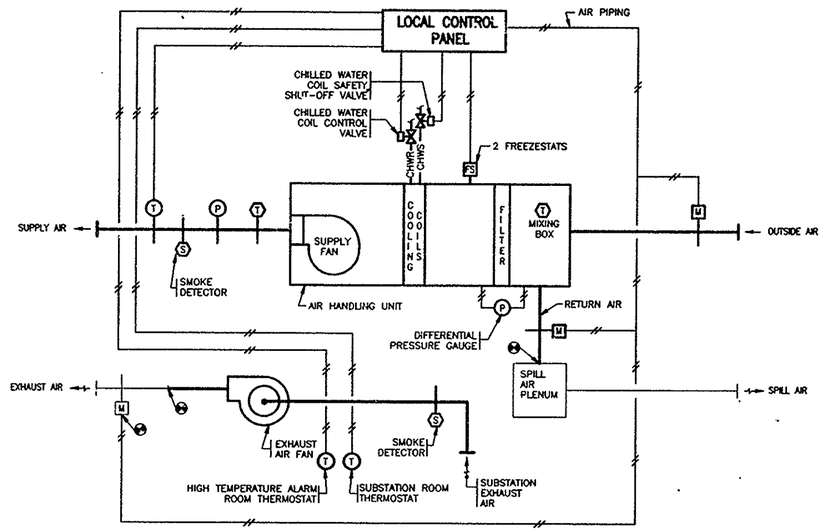


PERIPHERAL AIR CONDITIONING UNIT CONTROL
TYPICAL FOR ACS-41-1, 41-3, 75-1, 75-3, 75-2 AND 75-4



SUBSTATION AIR CONDITIONING UNIT CONTROL
TYPICAL FOR ACS-41N, 41S, 75N, 75S, 75W AND 75E

SEQUENCE OF OPERATION

PERIPHERAL AIR CONDITIONING UNITS

1. WHEN THE SUPPLY FAN IS NOT OPERATING, THE OUTSIDE AIR INTAKE DAMPER SHALL BE CLOSED, THE RETURN AIR DAMPER SHALL BE OPEN, THE CHILLED WATER CONTROL VALVE SHALL BE CLOSED.
2. THE OPERATION OF THE SUPPLY AND RETURN FANS SHALL BE INTERLOCKED WHENEVER THE ACS IS IN THE WINTER OR SUMMER CYCLE.
3. THE NORMALLY CLOSED OUTDOOR AIR AND THE NORMALLY OPEN RETURN AIR DAMPER SHALL BE INTERLOCKED TO OPERATE WHENEVER THE ACS IS IN OPERATION. ON INITIAL START UP, IN THE WINTER OR SUMMER CYCLE, THE OUTDOOR AIR DAMPERS SHALL REMAIN CLOSED AND THE RETURN AIR DAMPER OPEN UNTIL THE DISCHARGE THERMOSTAT SETPOINT IS SATISFIED TO PROVIDE SPACE WARM-UP AND COOL DOWN.
4. THE OPERATION OF THE ACS SHALL BE INTERLOCKED WITH ITS FREEZESTAT TO STOP, INDICATE AN ALARM, AND CLOSE THE OUTDOOR AIR DAMPER IF THE FREEZESTAT SETPOINT OF 35 DEG. F IS REACHED.
5. A SUMMER/WINTER SWITCH SHALL BE PROVIDED ON THE LOCAL CONTROL PANEL.

SUMMER/ECONOMIZER CYCLE

1. AIR ECONOMIZER COOLING MODE CONTROL SHALL BE PROVIDED. THE CONTROL SYSTEM SHALL AUTOMATICALLY SELECT BETWEEN ECONOMIZER AND MECHANICAL COOLING BASED ON OUTDOOR AIR DRY BULB TEMPERATURE.
2. IN THE ECONOMIZER COOLING MODE, THE DISCHARGE AIR THERMOSTAT SHALL MODULATE THE OUTDOOR AND RETURN AIR DAMPERS TO PROVIDE VENTILATION COOLING.
3. IN THE MECHANICAL COOLING MODE THE OPERATION OF THE ACS SHALL BE CONTROLLED BY THE UNITS DISCHARGE AIR THERMOSTAT, THE OUTDOOR AIR DAMPER SHALL BE IN ITS MINIMUM POSITION, THE RETURN AIR DAMPER SHALL BE POSITIONED AS REQUIRED, AND THE STEAM CONTROL VALVE SHALL REMAIN DE-ENERGIZED.
4. ON A RISE OR DECREASE IN DISCHARGE AIR TEMPERATURE ABOVE OR BELOW THE SETPOINT, THE DISCHARGE AIR THERMOSTAT SHALL MODULATE THE CHILLED WATER CONTROL VALVE TO MAINTAIN THE ISETPOINT.

WINTER CYCLE

1. IN THE WINTER CYCLE, THE OPERATION OF THE ACS SHALL BE CONTROLLED BY THE DISCHARGE AIR THERMOSTAT, THE OUTDOOR AIR DAMPER SHALL BE IN THE MINIMUM POSITION, THE CHILLED WATER CONTROL VALVE SHALL BE DE-ENERGIZED AND THE RETURN AIR DAMPERS SHALL BE POSITIONED AS REQUIRED.
2. ON A DECREASE OR RISE IN DISCHARGE AIR TEMPERATURE ABOVE OR BELOW THE SETPOINT THE DISCHARGE AIR THERMOSTAT SHALL MODULATE THE STEAM CONTROL VALVE TO MAINTAIN THE SETPOINT.

FAN INTERLOCK SCHEDULE

ACS UNIT	LOCATION TOWER	RETURN AIR FAN (ACR)
41-1 NORTH	A	41-3
41-3 SOUTH	A	41-9
75-1 NORTH	A	75-3
75-3 SOUTH	A	75-9
75-2 EAST	B	75-9
75-4 WEST	B	75-3

SMOKE PURGE

A. UPON DETECTION OF SMOKE, THE DUCT SMOKE DETECTOR SHALL ACTIVATE THE BUILDING FIRE ALARM SYSTEM WHICH SHALL SHUT-DOWN THE FANS SERVING THE AFFECTED AREA, CLOSE RETURN, AND OUTSIDE AIR DAMPERS. ACTIVATION OF A KEY OPERATED SWITCH ON THE SMOKE PURGE PANEL SHALL SET THE SMOKE PURGE IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:

1. THE SPILL DAMPER SHALL BE OPEN.
2. THE OUTDOOR AIR DAMPER SHALL REMAIN CLOSED.
3. THE RETURN AIR DAMPER SHALL CLOSED.
4. THE SUPPLY FAN SHALL REMAIN STOPPED.
5. THE RETURN FAN SHALL OPERATE TO EXHAUST AIR AND SMOKE FROM THE SPACE.

SEQUENCE OF OPERATION

SUBSTATION AIR CONDITIONING UNIT(S) SYSTEM

GENERAL

1. WHEN THE SUPPLY FAN IS NOT OPERATING, THE OUTSIDE AIR INTAKE DAMPER SHALL BE CLOSED, THE RETURN AIR DAMPER SHALL BE OPEN, THE CHILLED WATER CONTROL VALVE SHALL BE CLOSED.
2. THE SUPPLY AND EXHAUST FAN(S) SHALL BE INTERLOCKED TO RUN WHENEVER THE SUBSTATION AIR CONDITIONING UNIT SYSTEM IS IN OPERATION.
3. THE NORMALLY CLOSED OUTDOOR AIR AND THE NORMALLY OPEN RETURN AIR DAMPER SHALL BE INTERLOCKED TO OPERATE WHENEVER THE ACS IS IN OPERATION. THE NORMALLY CLOSED EXHAUST AIR DAMPER SHALL BE INTERLOCKED WITH EXHAUST AIR FANS.
4. THE OPERATION OF THE ACS SHALL BE INTERLOCKED WITH ITS FREEZESTAT TO STOP, INDICATE AN ALARM, AND CLOSE THE OUTDOOR AIR DAMPER IF THE FREEZESTAT SETPOINT OF 35 DEG. F IS REACHED.
5. BOTH THE SUPPLY AND RETURN(S) SHALL EACH HAVE MANUAL OVERIDE SWITCHES. EITHER FAN SHALL HAVE THE CAPABILITY TO RUN INDEPENDENTLY OR SIMULTANEOUSLY IN THE MANUAL OVERIDE MODE.
6. ON A RISE OR DECREASE IN THE ROOM AIR TEMPERATURE ABOVE OR BELOW 86 DEG. F., THE ROOM AIR THERMOSTAT SHALL RESET THE SETPOINT OF THE DISCHARGE AIR THERMOSTAT WHICH SHALL CONTROL IN SEQUENCE THE OUTDOOR AIR DAMPER, RETURN AIR DAMPER AND CHILLED WATER CONTROL VALVE TO MAINTAIN THE ROOM TEMPERATURE SETPOINT.
7. UPON REACHING 100 DEG. F. SETPOINT THE HIGH TEMPERATURE ALARM THERMOSTAT SHALL ACTIVATE AN ALARM AT B2 LEVEL START/STOP PANEL.

SMOKE PURGE

A. UPON DETECTION OF SMOKE THE DUCT SMOKE DETECTOR SHALL ACTIVATE THE BUILDING FIRE ALARM SYSTEM WHICH SHALL SHUT-DOWN THE FANS SERVING THE AFFECTED AREA, CLOSE RETURN, OUTSIDE AND EXHAUST AIR DAMPERS. ACTIVATION OF A KEY OPERATED SWITCH ON THE SMOKE PURGE PANEL SHALL SET THE SMOKE PURGE MODE IN ACCORDANCE WITH THE FOLLOWING PROCEDURE:

1. THE EXHAUST DAMPER SHALL BE OPEN.
2. THE OUTDOOR AIR DAMPER SHALL REMAIN CLOSED.
3. THE RETURN AIR DAMPER SHALL CLOSE.
4. THE SUPPLY FAN SHALL REMAIN STOPPED.
5. THE EXHAUST FAN SHALL OPERATE TO EXHAUST AIR AND SMOKE FROM THE SPACE.

I HEREBY CERTIFY THAT THIS IS A TRUE AND CORRECT COPY OF ONE OF THE CONTRACT DRAWINGS CONSTITUTING A PART OF CONTRACT NO. WTC-802.071 IN THE FORM IN WHICH SAID DRAWINGS EXISTED AT THE TIME THE SAID CONTRACT WAS EXECUTED BY THE PARTIES.

DATE 6/21/95 Sultan A. Aslam SPEC. WRITER

DATE 8/15/95 Peter K. Sweeney ENGINEER OF DESIGN

FILE NAME SS MS SCALE FACTOR 1-8"

Sheet 58 of 224

THE PORT AUTHORITY OF NY & NJ

Peter K. Sweeney ENGINEERING PROGRAM MANAGER WORLD TRADE

Alfred Kroner CHIEF MECHANICAL ENGINEER

No.	Date	Revision	Approved

Engineering Department
Design Division

The World Trade Center

Electrical/HVAC Upgrade Program

Title

TOWER ONE AND TWO LOW VOLTAGE SUBSTATIONS CONSTRUCTION AND INSTALLATION

MECHANICAL

CONTROL DIAGRAMS AND NOTES

A.B.	E.E.	S.W.
Designed by	Drawn by	Checked by

Date 5/1/95 Scale AS NOTED

Contract Number WTC-802.071 Drawing Number M-5